Quality Management System

SYLLABUS

on

«Designing of Machines and Mechanisms and Bases of Interchangeability»

Field of study: 13 «Mechanical engineering»
Speciality: 134 «Aviation and Space Rocket Technology»
Specialization: Airplanes and helicopters
Aircraft Equipment

Year of Study – 2\textsuperscript{nd} Semester – 4\textsuperscript{th}
Classroom Sessions – 85 Examination – 4\textsuperscript{th} semester
Self-study – 125
Total (hours/ECTS credits) – 210/7

Course Project – 4\textsuperscript{th} semester

Index CB-1-134/16-2.1.13

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The Syllabus on "Designing of Machines and Mechanisms and Bases of Interchangeability" is based on the educational and professional program and Bachelor Curriculum № CB-1-134/16 for Speciality 134 «Aviation and Space Rocket Technology» and Specializations «Airplanes and helicopters», «Aircraft Equipment» and correspondent normative documents.

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Discussed and approved by the Graduate Department for Speciality 134 «Aviation and Space Rocket Technology» and Specialization «Airplanes and helicopters» – the Hydraulic & Gaseous Systems Department, Minutes № _____ of _________2017.
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Discussed and approved by the Scientific-Methodological-Editorial Board of Educational and Research Airspace Institute, Minutes № of ___.
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Document level – 3b

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1. EXPLANATORY NOTE

The Syllabus of discipline "Designing of Machines and Mechanisms and Bases of Interchangeability" is developed on the basis of "The guidelines for the development and execution of training programs and work training courses", enacted by order 16.06.2015r. №37/p03.

The discipline “Designing of Machines and Mechanisms and Bases of Interchangeability” is the last general engineering discipline which combines engineering strength calculations theory and method of machines elements and units and provides fundamental engineering training of engineers.

The purpose of teaching the discipline is formation of students' knowledge about the basics of calculation and designing of typical general purpose machine elements and units and aircrafts and also main principals of interchangeability of details and assembly units in avia and rocket designing.

The main objective of the discipline is:
- to study the general principles of design and construction of elements and components of general and special purpose, which are found in a variety of mechanisms and machines;
- building models and computational algorithms of typical mechanical engineering with regard to the main criteria of efficiency that are needed in creating a new or upgrading existing and reliable operation of the industry equipment;
- studying methods of interchangeability of parts and assembly units at the designing, manufacturing and during their operation;
- ensuring the interchangeability with using "Unified system of tolerances and landings" in engineering.

As a result of studying the discipline a student shall:

KNOW:
- main types of modern mechanical transmissions, their structure and design
- principles of designing of mechanisms and machines and features of their functioning;
- method of material selection and determination of allowable stresses;
- method of strength calculation of aircrafts and mechanical transmission typical elements;
- method of calculation and design of mechanical engineering and aircraft mechanisms typical elements which carry and transmit rotatory motion;
- method of strength calculation of mechanical engineering and aircraft elements detachable and permanent joints;
- method of strength calculation of aviation mechanisms
- methodology of details interchangeability at designing, production and operation.

ABLE:
- to carry out engineering design strength calculation of typical machine elements and units;
- to develop a rational mechanism diagram;
- to solve certain design and construction tasks of elements and units on the base of given conditions of operation;
- to form a technical specification for general purpose elements and mechanisms design;
- to carry out the design documentation development stages and content of the individual design stages.

The subject matter of discipline is structured with module principle and is divided into tree modules. The separate forth module is a course project which is carried out in a forth semester.

Training module №1 „Bases of Interchangeability”, training module № 2 „Mechanical transmissions”, training module № 3 „Machine elements for carrying and transmitting rotatory power and Joints”, training module № 4 „Course project”, each of which is
logically complete, relatively independent, integral part of the discipline, learning of which provides for modular test and analysis of its doing and course project defense.


2. SUBJECT CONTENT

2.1. Module number 1 "Fundamentals of interchangeability";

Topic: 2.1.1 The physical nature of interchangeability and its importance in the development of engineering. Definition of interchangeability. Interchangeability direction as providing machines and mechanisms in their manufacture.


Topic: 2.1.3. Interchangeability key performance parameters for details. Interchangeability geometrical parameters for details. Interchangeability of physical and mechanical parameters details.

Topic: 2.1.4. Means of measurement in the interchangeability of parts. Classification of means of measurement and their purpose. Special equipment to determine the operating parameters of parts in interchangeability.

2.2. Module № 2 «Mechanical transmissions».

Topic 2.2.1. Basic concepts and definitions of basis for machinery calculation and design. The main directions of modern mechanical engineering and aircraft. The basic definition. The main criteria for machine performance. Basic requirements for elements and structures material.

Topic 2.2.2. Fundamentals of designing. The design concept. The design tasks. The machine design stages. Types and completeness of design documents. The basic concept of optimal design. The concept of automated design.

Topic 2.2.3. Mechanical transmissions general information. Purpose of transmissions and their classification. The basic kinematic and power ratios of transmissions. Using of mechanical transmissions in aviation technology.

Topic 2.2.4. Friction transmissions. General information, classification, design and principle of operation. Strength calculation of cylindrical friction transmissions. Friction transmissions in engineering.


Topic 2.2.9. Planetary gearings.
General information, gear ratio, field of use and varieties of planetary gearings. Forces in the engagement. Strength calculations of planetary gearings.

**Topic 2.2.10. Worm gearings.**


**Topic 2.2.11. Harmonic gearings.**


**Topic 2.2.12. Belt drives.**


**Topic 2.2.13. Chain drives.**


**Topic 2.2.14. Power screw transmissions.**

General information, design and classification. Field of drive application. Design and calculation of power screw transmissions with rolling and sliding friction. Power screw transmissions in aircrafts and technological equipment.

2.3. Module № 3. « Machine elements for carrying and transmitting rotatory power and Joints ».

**Topic 2.3.1. Axles and shafts.**


**Topic 2.3.2. Rolling contact bearings.**

General Information. Classification, labeling and accuracy classes of rolling bearings. The main types of rolling bearings. Selection of bearings for basic and static load rating. Design features of aviation reducers mounting group with rolling bearings.

**Topic 2.3.3. Sliding contact bearings.**


**Topic 2.3.4. Coupling.**


**Topic 2.3.5. Threaded joints.**


**Topic 2.3.6. Keyed and splined joints.**
General Information. The main types of keyed joints. Choosing of keys and check analysis of keyed joints.


**Topic 2.3.7. Riveted joints.**


**Topic 2.3.8. Welded joints.**

General information and industry use. The types of welds. Calculation of welded joints loaded by force and moment. Design of welded joints in engineering and aircraft structures.

**2.4. Module № 4 «Course project»**

Course project in the discipline is performed in the fourth semester, in order to consolidate and deepen the theoretical knowledge and skills on the basis of calculation and design of aviation mechanisms mechanical transmissions and drives.

Course project performing is an important stage for the diploma project prospective specialists in designing aircraft preparations.

**3. LIST OF REFERENCES**

**3.1. Basic recommended sources**


3.1.4. Гриценко В.Д., Кудрін А.П., Мамлюк О.В., Зайвенко Г.М., Пішта. О.І. Системи автоматизованого проектування в літакобудуванні. Навчальний посібник. – К.: НАУ. 2016. – 122с.

3.1.5. Павлашко В.Т. Основи конструювання та розрахунок деталей машин. К.: Вища шк., 1993. – 556 с.


**3.2. Additional recommended sources.**


3.2.2. Чернілевський В.Д., Павленко В.С., Любін М.В. Технічна механіка. Кн. 4. Деталі машин, К.: НМК ВО, 1992. – 360 с.

3.2.3. Цехович Л.І., Петриченко И.П. Атлас конструкции редукторов.- К.: „Вища школа”, 1990. – 151 с.

3.2.4. Баласанян Р.А. Атлас деталей машин. – Х.: Основа, 1996. – 256 с.
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**Syllabus on**

"Designing of Machines and Mechanisms and Bases of Interchangeability"

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